

What is Claimed:

1. A microfluidic chip, comprising:

a plurality of vias;

a functionalized porous polymer monolith capable of being in fluid communication with at least one of said vias;

a microarray capable of being in fluid communication with said functionalized porous polymer monolith; and

an observation port through which at least one target disposed within said microarray is capable of being detected.
2. The microfluidic chip of claim 1, wherein said microarray comprises at least one probe.
3. The microfluidic chip of claim 2, wherein said probe is capable of binding said at least one target.
4. The microfluidic chip of claim 3, wherein said at least one target comprises a nucleic acid, a protein, an antigen, an antibody, or any combination thereof.
5. The microfluidic chip of claim 4, wherein said nucleic acid comprises RNA, DNA, LNA, PNA, HNA, or any combination thereof.
6. The microfluidic chip of claim 4, wherein said nucleic acid of said target is capable of hybridizing with a nucleic acid of said probe.
7. The microfluidic chip of claim 6, wherein said nucleic acid of said target comprises cDNA.
8. The microfluidic chip of claim 4, wherein said nucleic acid comprises an oligonucleotide.
9. The microfluidic chip of claim 4, wherein said nucleic acid comprises a single stranded nucleic acid, a double stranded nucleic acid, or any combination thereof.

10. The microfluidic chip of claim 5, wherein said DNA is cDNA.
11. The microfluidic chip of claim 3, wherein said microarray comprises a plurality of probes capable of binding a plurality of targets.
12. The microfluidic chip of claim 11, wherein said microarray comprises at least about 1,000 probes.
13. The microfluidic chip of claim 11, wherein said microarray comprises at least about 5,000 probes.
14. The microfluidic chip of claim 11, wherein said microarray comprises at least about 10,000 probes.
15. The microfluidic chip of claim 11, wherein said microarray comprises up to about 50,000 probes.
16. The microfluidic chip of claim 11, wherein said plurality of probes comprises at least one probe different than the other probes.
17. The microfluidic chip of claim 16, wherein said probe different than the other probes is capable of binding at least one target different than the other targets.
18. The microfluidic chip of claim 17, wherein each of said probes is individually capable of binding a target different than the other targets.
19. The microfluidic chip of claim 2, wherein said at least one probe is disposed as at least one spot on the surface of a base substrate.
20. The microfluidic chip of claim 19, wherein said at least one spot is at least about 10 microns wide.
21. The microfluidic chip of claim 19, wherein said at least one spot is at least about 20 microns wide.

22. The microfluidic chip of claim 19, wherein said at least one spot is at least about 40 microns wide.
23. The microfluidic chip of claim 19, wherein said at least one spot is at least about 60 microns wide.
24. The microfluidic chip of claim 19, wherein said at least one spot is at most about 250 microns wide.
25. The microfluidic chip of claim 11, wherein said plurality of probes are disposed as a plurality of spots on the surface of a base substrate.
26. The microfluidic chip of claim 25, wherein said plurality of spots are each separated from one another by at least about 10 microns.
27. The microfluidic chip of claim 25, wherein said plurality of spots are each separated from one another by at least about 20 microns.
28. The microfluidic chip of claim 25, wherein said plurality of spots are each separated from one another by at least about 50 microns.
29. The microfluidic chip of claim 25, wherein said plurality of spots are each separated from one another by at least about 100 microns.
30. The microfluidic chip of claim 25, wherein said plurality of spots are each separated from one another by at most about 500 microns.
31. The microfluidic chip of claim 11, wherein said plurality of probes comprise an ordered arrangement.
32. The microfluidic chip of claim 31, wherein said ordered arrangement comprises from one to three dimensions.
33. The microfluidic chip of claim 31, wherein said plurality of probes are linearly arranged.

34. The microfluidic chip of claim 31, wherein said plurality of probes are linearly arranged in two dimensions.
35. The microfluidic chip of claim 33, wherein said plurality of probes are disposed as a plurality of spots on the surface of a base substrate.
36. The microfluidic chip of claim 35, wherein said plurality of spots are disposed within at least one microchannel.
37. The microfluidic chip of claim 36, wherein said at least one microchannel varies in direction along said surface of the substrate.
38. The microfluidic chip of claim 37, wherein said microchannel is from about 10 microns to about 500 microns wide and from about 1,000 microns to about 1,000,000 microns long.
39. The microfluidic chip of claim 37, wherein said at least one microchannel is disposed as a spiral path, a serpentine path, a curved path, a straight path in fluid communication with at least one other path, or any combination thereof.
40. The microfluidic chip of claim 39, wherein said serpentine path comprises a circular serpentine path, a rectangular serpentine path, or any combination thereof.
41. The microfluidic chip of claim 40, wherein a first section of said serpentine path is disposed adjacent to a second section of said serpentine path, the first and second sections being separated by a wall of non-zero thickness.
42. The microfluidic chip of claim 41, wherein the thickness of said wall is in the range of from about 10 microns to about 1,000 microns.
43. The microfluidic chip of claim 31, wherein said plurality of probes are planarly arranged in two dimensions.
44. The microfluidic chip of claim 43, wherein said plurality of probes are disposed as a plurality of spots on the surface of a base substrate.

45. The microfluidic chip of claim 44, wherein the plurality of spots are arranged in rows and columns, said rows and columns each numbering from about 10 to about 1,000.
46. The microfluidic chip of claim 44, wherein said plurality of spots are disposed within a microwell.
47. The microfluidic chip of claim 31, wherein said plurality of probes are spatially arranged in three dimensions.
48. The microfluidic chip of claim 11, wherein said plurality of probes comprise a disordered arrangement.
49. The microfluidic chip of claim 48, wherein said plurality of probes are disposed as a plurality of spots on the surface of a base substrate.
50. The microfluidic chip of claim 49, wherein the mean distance between the plurality of spots is in the range of from about 10 to 500 microns.
51. The microfluidic chip of claim 19, wherein said probe is capable of binding said at least one target, and said spot comprises at least about one monolayer of said probe.
52. The microfluidic chip of claim 51, wherein said probes comprise nucleic acids capable of hybridizing with said at least one target.
53. The microfluidic chip of claim 19, wherein said at least one probe is covalently bonded to said substrate.
54. The microfluidic chip of claim 53, further comprising a linker molecular covalently bonded between said probe and said substrate.
55. The microfluidic chip of claim 11, wherein said plurality of probes comprise nucleic acids, proteins, antigens, antibodies, or any combination thereof.
56. The microfluidic chip of claim 55, wherein said nucleic acids comprise RNA, DNA, LNA, PNA, HNA, or any combination thereof.

57. The microfluidic chip of claim 55, wherein said nucleic acids comprise an oligomer.
58. The microfluidic chip of claim 55, wherein said nucleic acids comprise a single stranded nucleic acid, a double stranded nucleic acid, or any combination thereof.
59. The microfluidic chip of claim 56, wherein said nucleic acids comprise cDNA.
60. The microfluidic chip of claim 59, wherein said target comprises cDNA capable of hybridizing with said probe.
61. The microfluidic chip of claim 1, wherein said functionalized porous polymer monolith is capable of binding a nucleic acid.
62. The microfluidic chip of claim 1, wherein said functionalized porous polymer monolith comprises pores having a surface, said pores permitting fluid communication through said functionalized porous polymer monolith.
63. The microfluidic chip of claim 62, wherein said functionalized porous polymer monolith comprises a highly crosslinked polymer.
64. The microfluidic chip of claim 63, wherein said highly crosslinked polymer comprises units derived from at least one mono-ethylenically unsaturated monomer, at least one multi-ethylenically unsaturated monomer, or a combination thereof.
65. The microfluidic chip of claim 64, wherein said at least one mono-ethylenically unsaturated monomer comprises glycidyl methacrylate.
66. The microfluidic chip of claim 64, wherein said at least one multi-ethylenically unsaturated monomer comprises ethylene glycol dimethacrylate.
67. The microfluidic chip of claim 63, wherein said highly crosslinked polymer comprises units derived from a radical reaction catalyzed by UV activation of bis(2,6-D, methoxybenzoyl)-2,4,4-trimethylphenyl phosphine oxide.
68. The microfluidic chip of claim 62, wherein said functionalized porous polymer monolith comprises pores smaller than about 10 microns.

69. The microfluidic chip of claim 62, wherein said functionalized porous polymer monolith comprises a void fraction of less than about 50 percent based on volume of said functionalized porous polymer monolith.
70. The microfluidic chip of claim 62, wherein said functionalized porous polymer monolith is capable of operating at pressures between 100 and 3000 PSI in an aqueous fluid at 25°C that is communicated therethrough.
71. The microfluidic chip of claim 62, wherein said functionalized porous polymer monolith is covalently bonded to a substrate.
72. The microfluidic chip of claim 62, wherein said functionalized porous polymer monolith comprises at least one functional group for binding a sample compound.
73. The microfluidic chip of claim 72, wherein said functional group comprises an amine-containing ligand, an alcohol-containing ligand, a thiol-containing ligand or a hydrazine-containing ligand, or any combination thereof.
74. The microfluidic chip of claim 72, wherein said functional group comprises a nucleic acid, a protein, an antibody, an antigen, an amine-containing ligand, or any combination thereof.
75. The microfluidic chip of claim 74, wherein said nucleic acid comprises an oligonucleotide.
76. The microfluidic chip of claim 75, wherein said oligonucleotide comprises oligo-T.
77. The microfluidic chip of claim 75, wherein said at least one target comprises cDNA capable of binding at least a portion of said oligonucleotide.
78. The microfluidic chip of claim 1, wherein said microarray and said functionalized porous polymer monolith are disposed between a base substrate and a cover substrate.
79. The microfluidic chip of claim 78, wherein said microarray is disposed on a top surface of said cover substrate.

80. The microfluidic chip of claim 79, wherein said cover substrate comprises a region above said microarray to provide said observation port.
81. The microfluidic chip of claim 1, wherein both of said functionalized porous polymer monolith and said microarray are disposed between a base substrate and a cover substrate.
82. The microfluidic chip of claim 81, wherein said plurality of vias are disposed within said base substrate, said cover substrate, or any combination thereof, said vias being in fluid communication with said functionalized porous polymer monolith, said microarray, or both.
83. The microfluidic chip of claim 82, wherein said vias are capable of being in fluid communication with fluidic devices external to said microfluidic chip.
84. The microfluidic chip of claim 1, wherein at least one of said vias is not in fluid communication with said functionalized porous polymer monolith.
85. The microfluidic chip of claim 1, wherein said functionalized porous polymer monolith is not in fluid communication with said microarray.
86. The microfluidic chip of claim 81, wherein said base substrate and said cover substrate are at least partially bonded together at a bonding surface.
87. The microfluidic chip of claim 86, wherein said base substrate comprises at least one microfluidic structure disposed at said bonding surface.
88. The microfluidic chip of claim 87, wherein said microfluidic structure comprises a microchannel, a microwell, a reservoir, a microelectrode, a microjunction, a microsplitter, a microfilter, a microreactor, a microvalve, a microsensor, a microinjector, a micromixer, a micropump, a microseparator, a micromanifold, or any combination thereof.
89. The microfluidic chip of claim 87, wherein said functionalized porous polymer monolith is disposed within said microfluidic structure.

90. The microfluidic chip of claim 89, wherein said microfluidic structure comprises a microchannel, a microwell, a reservoir, or any combination thereof.
91. The microfluidic chip of claim 89, wherein said microfluidic structure further comprises microposts bonded between said base substrate and said cover substrate, said microposts being capable of reducing the deformation of said cover substrate disposed above said microfluidic structure, being capable of mixing fluid flowing through said microfluidic structure, or both.
92. The microfluidic chip of claim 90, wherein said microwell or reservoir further comprises a micromanifold, said micromanifold capable of equalizing the pressure distribution within said microfluidic structure.
93. The microfluidic chip of claim 87, wherein said microarray is disposed within said microfluidic structure.
94. The microfluidic chip of claim 93, wherein said microfluidic structure comprises a microchannel, a microwell, a reservoir, or any combination thereof.
95. The microfluidic chip of claim 93, wherein said microwell or reservoir further comprises a micromanifold, said micromanifold capable of equalizing the pressure distribution within said microfluidic structure.
96. The microfluidic chip of claim 94, further comprising a microfluidic injector in fluid communication with said microfluidic structure, said microfluidic injector being capable of providing a fluid plug into said microarray.
97. The microfluidic chip of claim 96, wherein said microfluidic structure comprises a microwell or reservoir, and said microfluidic chip further comprising a microchannel disposed between said microfluidic injector and said microwell or reservoir.
98. The microfluidic chip of claim 87, wherein said microfluidic structure is disposed in a region comprising a dimension perpendicular to said bonding surface, said dimension being up to about 1,000 microns.

99. The microfluidic chip of claim 98, wherein said dimension is in the range of from about 1 to about 500 microns.
100. The microfluidic chip of claim 98, wherein said dimension is in the range of from about 5 to about 250 microns.
101. The microfluidic chip of claim 98, wherein said dimension is in the range of from about 10 to about 100 microns.
102. The microfluidic chip of claim 87, wherein said microfluidic structure is disposed in a region comprising a dimension parallel to said bonding surface, said dimension being up to about 100,000 microns.
103. The microfluidic chip of claim 102, wherein said dimension is in the range of from about 10 to about 50,000 microns.
104. The microfluidic chip of claim 102, wherein said dimension is in the range of from about 50 to about 25,000 microns.
105. The microfluidic chip of claim 102, wherein said dimension is in the range of from about 100 to about 10,000 microns.
106. The microfluidic chip of claim 86, wherein said base substrate comprises a plurality of microfluidic structures in said bonding surface.
107. The microfluidic chip of claim 106, wherein said plurality of microfluidic structures comprises a microchannel, a microwell, a reservoir, a microelectrode, a monolith channel, or any combination thereof.
108. The microfluidic chip of claim 86, wherein said cover substrate comprises a region not bonded to said base substrate to provide said observation port.
109. The microfluidic chip of claim 108, wherein said region comprises an opening in said cover substrate.

110. The microfluidic chip of claim 109, wherein said opening is disposed above said microarray.
111. The microfluidic chip of claim 1, further comprising a derivatization reservoir capable of being in fluid communication with said functionalized porous polymer monolith.
112. The microfluidic chip of claim 111, wherein said derivatization reservoir comprises a functionalized porous polymer monolith for trapping target nucleic acids.
113. The microfluidic chip of claim 111, wherein said derivatization reservoir comprises an oligo (dT), a random oligo sequence, a gene family specific sequence, a protein ligand, or a protein receptor, or any combination thereof for stabilizing target nucleic acids or proteins.
114. The microfluidic chip of claim 1, further comprising one or more mobile monolith valves capable of controlling fluid flow in said microfluidic chip.